AESOP

Assessing the Effectiveness of Submesoscale Ocean Parameterizations

Office of Naval Research

Departmental Research Initiative

FY05-start

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The Navy-relevant issue: accurate forecasts of the ocean environment are necessary for a wide range of naval operations and applications

The problem: as models are run at higher resolutions, it is becoming increasingly difficult to verify model performance and predictions

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In order to generate and accurate prediction of the ocean conditions, one needs:

1. The correct initial state

2. Adequate boundary and surface forcing

3. An accurate numerical model that incorporates all of the relevant dynamics of the ocean to propagate the model state forward in time

While initial conditions and forcing are obviously important issues, it can probably be argued that for prediction, the fidelity of the model itself must be addressed first as a matter of necessity.

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The primary goal: define new methods to assess the submesoscale parameterizations used in high-resolution ocean models, specifically with respect to their impact on synoptic model predictions

For our purposes: sub-mesoscale ~ 100 m to 10 km

The focus will be on the actual representation of features and processes in short-term model predictions, to determine how well the model parameterizations are capturing the unresolved physics in real time.

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This effort is slightly similar to NSF's CPT effort in that we're asking process modelers, observationalists, and large-scale modelers to work together, but different in other respects.

In the CPT's, "the key aim is to speed development of coupled global climate models and reduce uncertainties in climate models" through parameterization development.

In AESOP, the focus is not primarily on the creation of new parameterizations, but on how one should assess them in determining their usefulness in making *synoptic* predictions.

If someone devised a perfect, scalable parameterization to incorporate a particular process…

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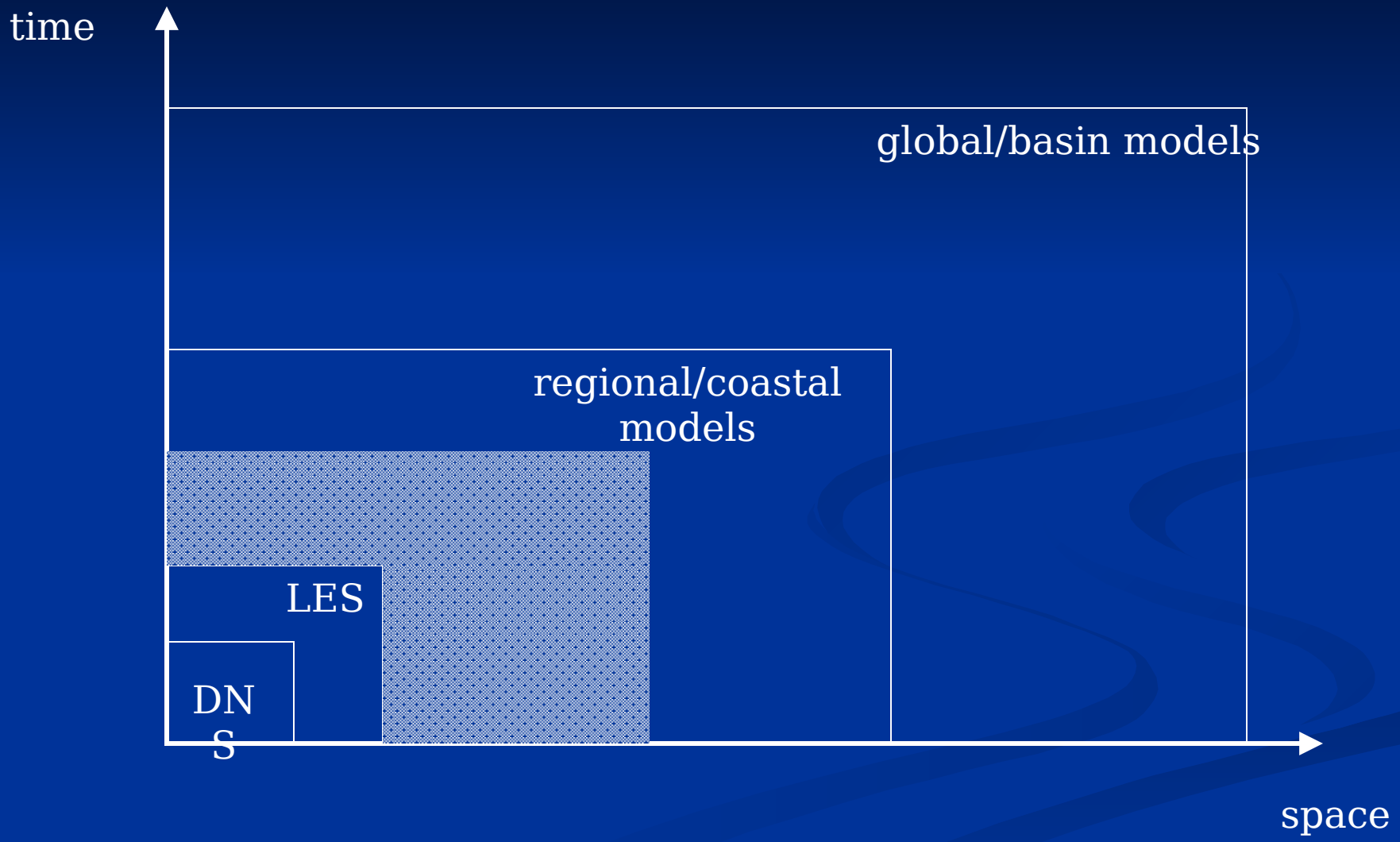
time
global/basin models
regional/coastal models
LES
DNS
space

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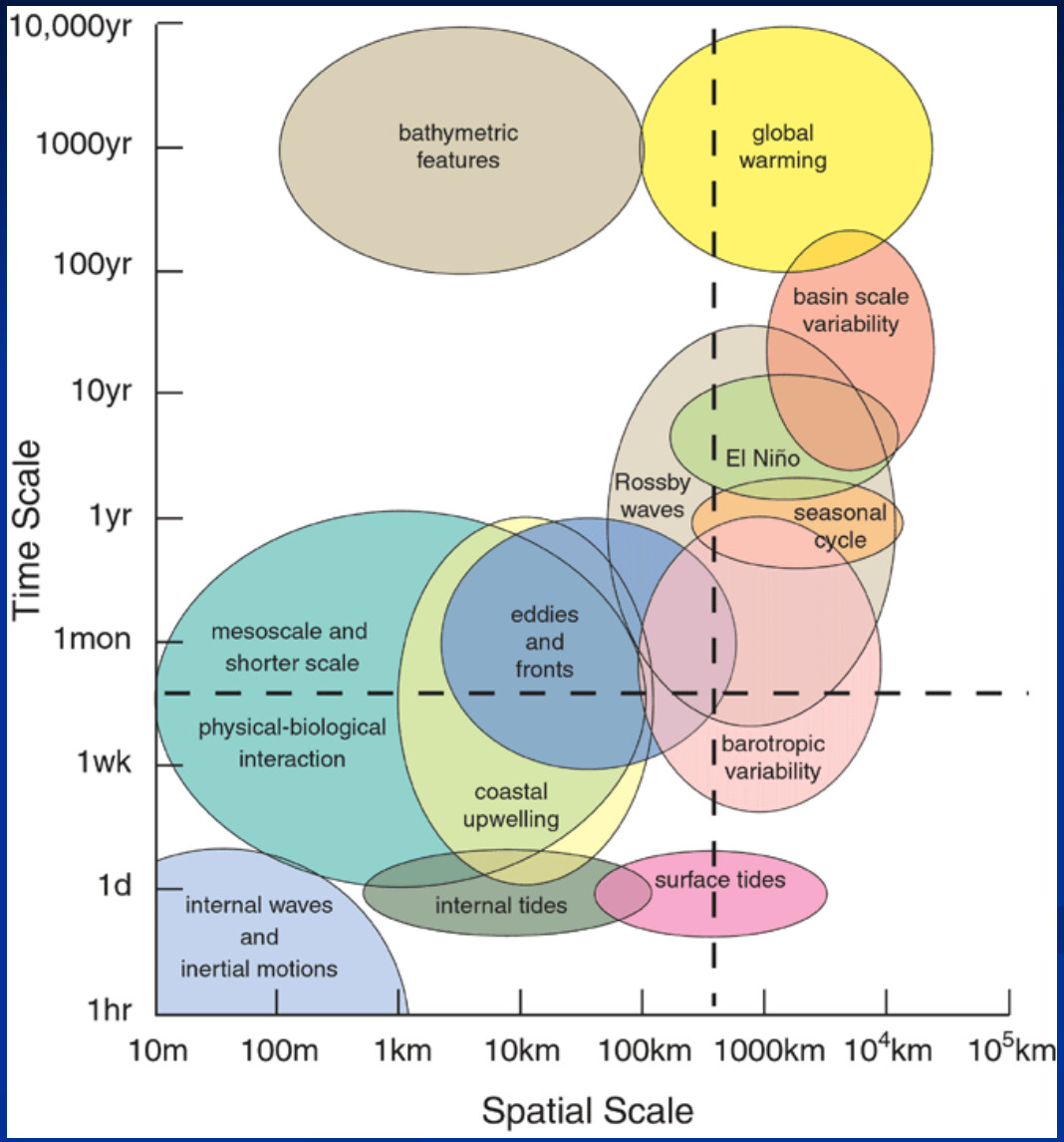
The models we are primarily concerned with (in this DRI) *resolve* the mesoscale and must *parameterize* the many different sub-mesoscale processes.

Some potential issues: these sub-mesoscale processes are often intermittent, spatially inhomogeneous, and less-well characterized than the mesoscale eddy field.



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Expected components:

- at least one significant field study to observe the ocean at the appropriate spatial and temporal scales
- numerical simulation of the field area(s), using different models and parameterizations at a variety of spatial resolutions
- theoretical work and process studies that might suggest appropriate parameterizations

We may try to leverage against at least one field effort that will be characterizing the mesoscale environment in Monterey Bay, so that we may focus on observing the smaller scale processes in the region .

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Some examples of questions we hope to address:

- What are the physical processes that are difficult to parameterize, limiting our ability to run realistic high-resolution simulations?
- How should one choose between parameterizations?
- What is an “improved” parameterization?
- Can we define the processes that dominate the dynamics at various resolutions?
- How sensitive are synoptic model predictions to the parameterized viscosity and diffusion?

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Some desired products we hope to generate:

- new methods for assessing parameterizations
- new knowledge about submesoscale ocean processes
- insight into the relative importance of different processes at various resolutions
- information on how current parameterizations affect ocean predictions
- new methods to evaluate high-resolution models and their predictions